

## CLAIMS

We claim:

1. A method for routing packets of data from a source to a plurality of routers and receivers in a hierarchical network comprising the steps of :
  - 5 assigning each router in said network to one of a plurality of hierarchical levels;
  - identifying a scope region bounded by one or more of the plurality hierarchical levels in which to route said packets of data;
  - identifying a root identifier for the scope region;
  - forwarding packets of data from said source to the routers in the network wherein said
  - 10 packets of data contain data fields identifying the scope region and the root identifier of the scope region.
2. The method of claim 1 further comprising the steps of:
  - identifying each router that is capable of sending packets of data to or from a router at
  - 15 a higher or lower level as a hierarchical designated router;
  - identifying the root identifier for the scope region as the hierarchical designated router directly above the scope region.
3. The method of claim 2 further comprising the steps of:
  - 20 identifying a binding point for providing a linkage between the scope region and a location for a receiver that has moved outside the scope region.
4. The method of claim 1 further comprising, prior to the forwarding step, the steps of:
  - receiving a packet of data at a router in the network;
  - determining whether the router is within the scope region specified in the data field
  - 25 identifying the scope region for the packet of data; and,
  - discarding the data packet is the router is outside the scope region.

5. A method of joining a receiver to a multicast tree of a multicast session for receiving data packets from a source wherein the source is sending data packets to a plurality of routers in a scope region in a hierarchical network of routers for the multicast session having an application identifier comprising the steps of:

5 obtaining at the joining receiver the scope region and the application identifier of the multicast session from the source;

sending a root identifier request from the joining receiver to a first parent router to which said joining receiver is in communication wherein said root identifier request contains the scope region and the application identifier of the multicast session;

10 determining at the first parent router whether the first parent router is within the scope region;

if the first parent router is within the scope region, locating the root identifier for the scope region at the first parent router;

invoking a join operation at the first parent router to join the receiver to the multicast session;

15 and then replying from the first parent router to the receiver with a root identifier reply message once the join operation is completed.

6. The method of claim 5 wherein the step of invoking a join operation further comprises the steps of:

determining if the first parent router is part of the multicast tree;

if the first parent router is not part of the multicast tree, setting up a transient forwarding cache at the first parent router consisting of a group address and a corresponding outgoing interface for the joining receiver;

25 sending a join message from the first parent router to a second parent router;

receiving an acknowledge message from the second parent at the first parent router after the second parent router has joined the multicast tree.

7. The method of claim 6 further comprising:

determining at the first parent router if there is a transient forwarding cache for the group address specified in the acknowledge message;

5 switching the transient forwarding cache to a confirmed forwarding cache prior to replying with the root identifier to the receiver.

8. The method of claim 5 wherein the joining receiver receives the scope region and the application identifier from the source through the Internet.

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9. The method of claim 5 wherein the joining receiver receives the scope region and the application identifier from the source through session announcement protocol.

10. The method of claim 5 wherein the joining receiver receives the scope region and the application identifier through session description protocol.

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11. In a hierarchical network, a method for receiving at a receiver packets of data routed by routers from a source as part of a multicast session identified by a scope region having a unique root identifier and an application identifier wherein the receiver has moved from being in communication with a first router to being in communication with a second router comprising the step of:

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sending a mobility report message from the mobile receiver to the second router wherein the mobility report message contains data identifying the scope region of the multicast session, the application identifier of the multicast session and the root identifier of the scope region.

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12. The method of claim 11 further comprising the steps of:

receiving the mobility report message at the second router;  
determining at the second router if the second router is outside the scope region; and,  
invoking a mobile join operation if the router is outside the scope region.

5           13. The method of claim 12 wherein the step of invoking a mobile join operation  
comprises the step of:

          sending a mobile join message from the second router toward a third router toward the  
router associated with the root identifier.

10           14. The method of claim 13 wherein the step of sending a join message toward a  
router associated with the root identifier further comprises the steps of:

          placing a transient entry in the forwarding cache indicating the router associated with  
the root identifier as source of data packets to be forwarded to the mobile receiver.

15           15. The method of claim 13 wherein the mobile join message is sent by the second  
router to all other routers with which it is in communication.

          16. The method of claim 13 wherein the step of invoking the mobile join operation  
further comprises the steps of:

20           receiving the mobile join message at the third router;  
          determining at the third router whether the third router is the binding point for  
communication to the mobile receiver wherein the binding point is the router that provides a  
linkages between the scope region and the mobile receiver through the shortest path.

25           17. The method of claim 16 wherein the third router is the binding point if the address  
of the third router is equal to the root identifier or if the address of any ascendant router in  
which the third router is in communication is equal to the root identifier.

18. The method of claim 16 further comprising the steps of:

sending a mobile acknowledge message from the third router to the second router once the binding point has been determined.

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19. The method of claim 18 further comprising the steps of:

sending a mobile reply message from the second router to the mobile receiver; and,

forwarding packets of data from the multicast session to the mobile receiver through the binding point, the third router and the second router.

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20. A method of forwarding packets of data from a multicast session in a network of routers arranged into a plurality of hierarchical levels comprising the step of forwarding packets of data between routers, wherein said packets of data contain data identifying a scope region containing the lower and upper hierarchical levels to which the packets will be forwarded, an application identifier for the multicast session and a unique root identifier for the scope region.

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